CLAIMS

What is claimed is:

1. A process for producing HFC-227ea comprising the steps of:

(a) contacting C-3 reactants selected for the group consisting of aliphatic, olefinic, or partially halogenated hydrocarbons having at least three carbon atoms, with Cl_2 and HF in the presence of a metal containing catalyst at a sufficient first temperature to form perhalogenated compounds;

(b) contacting the perhalogenated compounds with HF in the presence of a metal containing catalyst at a sufficient second temperature to form CFC-216aa;

(c) contacting the CFC-216aa with HF in the presence of a metal containing catalyst at a sufficient third temperature to form CFC-217ba; and

(d) contacting the CFC-217ba with H_2 in the presence of a metal containing catalyst at a sufficient fourth temperature to produce HFC-227ea.

2. The process of claim 1 wherein the first temperature is at least about 150°C, the second temperature is at least about 300°C, the third temperature is at least about 200°C and the fourth temperature is at least about 30°C.

3. The process of claim 2 wherein the first temperature is from about 150°C to about 450°C, the second temperature is from about 300°C to about

550°C, the third temperature is from about 200°C to about 550°C and the fourth temperature is from about 30°C to about 275°C.

4. The process of claim 3 wherein the first temperature is about 220°C, the second temperature is about 470°C, the third temperature is about 470°C and the fourth temperature is about 185°C.

5. The process of claim 1 wherein the molar ratio of HF:Cl_2 used in step (a) is from about 0.75:1 to about 8:1.

6. The process of claim 5 wherein the molar ratio of HF:Cl_2 used in step (a) is about 4:1.

7. The process of claim 1 wherein the molar ratio of Cl_2 to C-3 reactants used in step (a) is from about 8:1 to about 10:1.

8. The process of claim 7 wherein the molar ratio of Cl_2 to C-3 reactants used in step (a) is about 8.2:1.

9. The process of claim 1 wherein the molar ratio of HF to C-3 reactants used in step (a) is from about 6:1 to about 64:1.

10. The process of claim 9 wherein the molar ratio of HF to C-3 reactants used in step (a) is about 35:1.

11. The process of claim 1 wherein the molar ratio of HF to perhalogenated compounds used in step (b) is from about 6:1 to about 64:1.

12. The process of claim 11 wherein the molar ratio of HF to perhalogenated compounds in step (b) is about 30:1.

13. The process of claim 1 wherein the molar ratio of HF to CFC-216aa used in step (c) is from about 1:1 to about 30:1.

14. The process of claim 13 wherein the molar ratio of HF to CFC-216aa used in step (c) is about 10:1.

15. The process of claim 1 wherein the molar ratio of H_2 to CFC-217ba used in step (d) is from about 0.2:1 to about 10:1.

16. The process of claim 15 wherein the molar ratio of H_2 to CFC-217ba used in step (d) is about 1.2:1.

17. The process of claim 1 further comprising the addition of water in step (d).

18. The process of claim 17 wherein the water is present in an amount from about 0.04 to about 12 percent by weight of the C_3ClF_7.

19. The process of claim 18 wherein the water is about 0.8 percent by weight of the CFC-217ba.

20. The process of claim 1 further comprising the addition of Cl_2 in step (b).

21. The process of claim 1 wherein the metal containing catalyst of step (a) comprises chromium and a catalyst support.

22. The process of claim 1 wherein the metal containing catalyst of step (b) comprises chromium and a catalyst support.

23. The process of claim 1 wherein the metal containing catalyst of step (c) comprises chromium and a catalyst support.

24. The process of claim 1 wherein the metal containing catalyst of step (d) comprises Pd and a catalyst support.

25. The process of claim 1 further comprising the addition of diluent in at least one of steps (a)-(d).

26. The process of claim 1 wherein, in at least one of steps (a)-(c), underfluorinated products are recycled to at least one of steps (a)-(c).

27. A process of hydrodehalogenating a halogenated organic compound comprising:

providing a halogenated organic compound; and

contacting the halogenated organic compound with H_2, H_2O and catalyst to form a hydrodehalogenation reaction product.

28. The process of claim 26 wherein the halogenated organic compound comprises CFC-217ba.

29. The process of claim 26 wherein the ratio of H_2 to halogenated organic compound is from about 0.2:1 to about 10:1.

30. The process of claim 26 wherein the ratio of H_2 to halogenated organic compound is about 1.2:1.

31. The process of claim 26 wherein the H_2O is from about 0.04 to about 12 percent by weight of the halogenated organic compound.

32. The process of claim 30 wherein the H_2O is about 0.8 percent by weight of the halogenated organic compound.

33. The process of claim 26 wherein the catalyst contains a metal.

34. The process of claim 33 wherein the catalyst comprises Pd and a catalyst support.

35. A process for separating the isomers HFC-227ea and HFC-227ca comprising:

providing a mixture containing HFC-227ea, HFC-227ca and chlorofluorocarbon;

and

separating by distillation the mixture to obtain essentially pure HFC-227ea

isomer.

36. The process of claim 35 wherein the chlorofluorocarbon comprises C_3ClF_7.

37. The process of claim 35 wherein the chlorofluorocarbon to HFC-227ea ratio is from about 0.1 to about 10.

38. The process of claim 37 wherein the chlorofluorocarbon to HFC-227ea ratio is about 1:2.

39. A process for producing HFC-227ea comprising the steps of:

(a) contacting C-3 reactants selected from the group consisting of aliphatic, olefinic or partially halogenated hydrocarbons having at least three carbon atoms, with Cl_2 and HF in the presence of a metal containing catalyst at a sufficient first temperature to form perhalogenated compounds;

(b) contacting the perhalogenated compounds with HF in the presence of a metal containing catalyst at a sufficient second temperature to form CFC-217ba; and

(c) contacting the 217ba with H_2 in the presence of a metal containing catalyst at a sufficient third temperature to produce HFC-227ea.

40. The process of claim 39 wherein the first temperature is at least about 150°C, the second temperature is at least about 200°C and the third temperature is at least about 30°C.

41. The process of claim 40 wherein the first temperature is from about 150°C to about 300°C, the second temperature is from about 200°C to about 550°C and the third temperature is from about 30°C to about 275°C.

42. The process of claim 41 wherein the first temperature is about 220°C, the second temperature is about 470°C, and the third temperature is about 185°C.

43. The process of claim 39 wherein the molar ratio of HF:Cl_2 used in step (a) is from about 0.75:1 to about 8:1.

44. The process of claim 43 wherein the molar ratio of HF:Cl_2 used in step (a) is about 4:1.

45. The process of claim 39 wherein the molar ratio of Cl_2 to C-3 reactants used in step (a) is from about 8:1 to about 10:1.

46. The process of claim 45 wherein the molar ratio of Cl_2 to C-3 reactants used in step (a) is about 8.2:1.

47. The process of claim 39 wherein the molar ratio of HF to C-3 reactants used in step (a) is from about 6:1 to about 64:1.

48. The process of claim 47 wherein the molar ratio of HF to C-3 reactants used in step (a) is about 35:1.

49. The process of claim 39 wherein the molar ratio of HF to perhalogenated compounds used in step (b) is from about 6:1 to about 64:1.

50. The process of claim 49 wherein the molar ratio of HF to perhalogenated compounds in step (b) is about 30:1.

51. The process of claim 39 wherein the molar ratio of H_2 to CFC-217ba used in step (c) is from about 0.2:1 to about 10:1.

52. The process of claim 51 wherein the molar ratio of H_2 to CFC-217ba used in step (c) is about 1.2:1.

53. The process of claim 39 further comprising the addition of water in step (c).

54. The process of claim 53 wherein the water is present in an amount from about 0.04 to about 12 percent by weight of the CFC-217ba.

55. The process of claim 54 wherein the water is about 0.8 percent by weight of the CFC-217ba.

56. The process of claim 39 further comprising the addition of Cl_2 in step (b).

57. The process of claim 39 wherein the metal containing catalyst of step (a) comprises chromium and a catalyst support.

58. The process of claim 39 wherein the metal containing catalyst of step (b) comprises chromium and a catalyst support.

59. The process of claim 39 wherein the metal containing catalyst of step (c) comprises Pd and a catalyst support.

60. The process of claim 39 further comprising the addition of diluent in at least one of steps (a)-(b).

61. The process of claim 39 wherein, in at least one of steps (a)-(b), underfluorinated products are recycled to at least one of steps (a)-(b).

62. A process for purifying halogenation reaction products comprising:

providing halogenation reaction products comprising C-3 chlorofluorinated compounds and HF;

adjusting the temperature of the halogenation reaction products to a temperature sufficient to separate the reaction products into separate top and bottom phases, including a top phase containing HF and a bottom phase containing a C-3 chlorofluorinated compound; and

removing the top phase to obtain essentially pure HF or removing the bottom phase to obtain essentially pure C-3 chlorofluorinated compound.

63. The process of claim 62 wherein the C-3 chlorofluorinated compounds have at least six fluorine atoms.

64. The process of claim 62 wherein the temperature is from about -30°C to about -10°C.

65. The process of claim 64 wherein the temperature is about -20°C.

66. A process for separating C-3 chlorofluorinated compounds having at least six fluorine atoms from C-3 chlorofluorinated compounds having less than six fluorine atoms comprising:

providing a solution comprising C-3 chlorofluorinated compounds having at least six fluorine atoms and C-3 chlorofluorinated compounds having less than six fluorine atoms;

contacting the solution with water to form a water mixture therewith;

adjusting the temperature of the water mixture to a sufficient temperature to separate the water mixture into at least three phases, including an upper gas phase containing C-3 chlorofluorinated compounds having at least six fluorine atoms, a top primarily aqueous phase and a lower most liquid phase containing C-3 chlorofluorinated compounds having less than six fluorine atoms; and

removing the upper gas phase to obtain therefrom essentially pure C-3 chlorofluorinated compounds having at least six fluorine atoms.

67. The process of claim 66 wherein the C-3 chlorofluorinated compounds having at least six fluorine atoms comprise CFC-216aa.

68. The process of claim 66 wherein the temperature is from about 25°C to about 75°C.

69. The process of claim 68 wherein the temperature is about 50°C.

70. The process of claim 66 wherein the water includes a basic compound.

71. The process of claim 70 wherein the basic compound comprises KOH.

72. A process of separating C-3 chlorofluorinated compounds from a halogenation reaction product comprising:

providing a halogenation reaction product comprising C-3 chlorofluorinated compounds, HCl and HF;

adjusting the temperature of the halogenation reaction product to a sufficient temperature to separate the reaction product into at least three phases, including an upper gas phase containing HCl, a top liquid phase containing HF and a bottom liquid phase containing essentially acid-free C-3 chlorofluorinated compounds;

removing the bottom liquid phase to obtain essentially pure C-3 chlorofluorinated compounds.

73. The process of claim 72 wherein the C-3 chlorofluorinated compounds comprise CFC-217ba.

74. The process of claim 72 wherein the temperature is from about 20°C to about 75°C.

75. The process of claim 74 wherein the temperature is about 25°C.

76. A process for increasing the isomeric purity of chlorofluorinated compounds comprising:

providing a mixture of C-3 chlorofluorinated isomers; and

heating said mixture in the presence of a catalyst at a sufficient temperature to reduce the amount of at least one of the chlorofluorinated compound isomers.

77. The process of claim 76 wherein the C-3 chlorofluorinated compound isomers comprise CFC-216aa and CFC-216ba.

78. The process of claim 76 wherein the C-3 chlorofluorinated compound isomers comprise CFC-217ba and CFC-217ca.

79. The process of claim 76 wherein the catalyst comprises a chromium containing catalyst.

80. The process of claim 76 wherein the temperature is from about 250°C to about 350°C.

81. The process of claim 80 wherein the temperature is about 280°C.

82. A process for the selective halogenation of C-3 fluorinated isomers within an isomeric mixture comprising:

providing an isomeric mixture; and

contacting said mixture with Cl_2 in the presence of a catalyst at sufficient temperature to halogenate at least one isomer.

83. The process of claim 82 wherein the isomeric mixture comprises HFC-227ea and HFC-227ca.

84. The process of claim 82 wherein the catalyst comprises activated carbon.

85. The process of claim 82 wherein the temperature is from about 200°C to about 350°C.

86. The process of claim 85 wherein the temperature is about 300°C.

87. The process of claim 82 wherein the molar ratio of Cl_2 to isomeric mixture is from about 0.16:1 to about 3:1.

88. The process of claim 87 wherein the molar ratio of Cl_2 to isomeric mixture is about 2.5:1.